

74HC9115

Nine wide Schmitt trigger buffer; open drain outputs

Rev. 3 — 10 April 2018

Product data sheet

1 General description

The 74HC9115 is a 9-bit buffer with Schmitt trigger inputs and open drain outputs. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} . Schmitt trigger inputs transform slowly changing input signals into sharply defined jitter-free output signals.

2 Features and benefits

- Wide operating voltage 2.0 V to 6.0 V
- Schmitt trigger action on all data inputs
- CMOS low power dissipation
- High noise immunity
- Unlimited input rise and fall times
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
 - JESD8C (2.7 V to 3.6 V)
 - JESD7A (2.0 V to 6.0 V)
- ESD protection:
 - HBM JESD22-A114-A exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3 Ordering information

Table 1. Ordering information

| Type number | Package | | | |
|-------------|---|------|---|----------|
| | Temperature range | Name | Description | Version |
| 74HC9115D | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SO20 | plastic small outline package; 20 leads; body width 7.5 mm | SOT163-1 |

4 Functional diagram

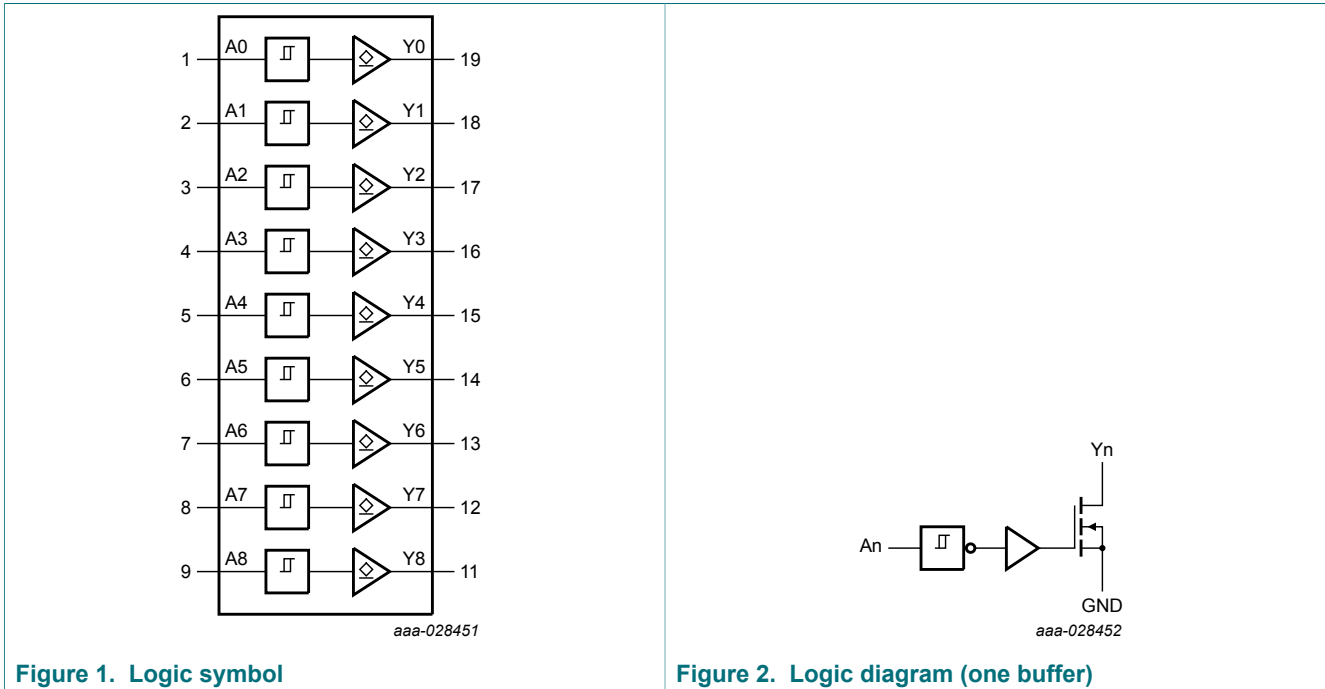


Figure 1. Logic symbol

Figure 2. Logic diagram (one buffer)

5 Pinning information

5.1 Pinning

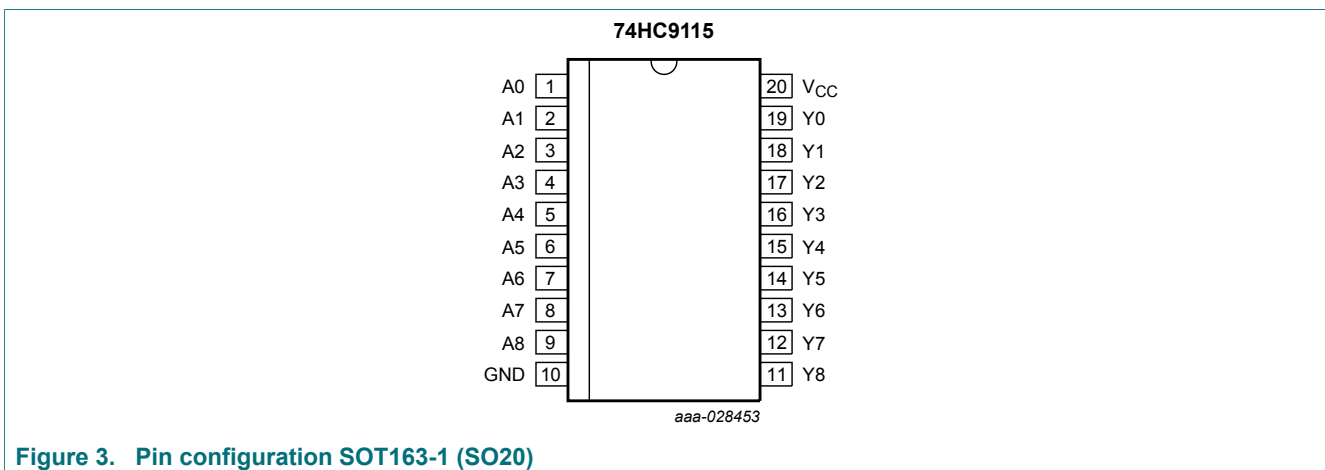


Figure 3. Pin configuration SOT163-1 (SO20)

5.2 Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|------------------------------------|------------------------------------|----------------|
| A0, A1, A2, A3, A4, A5, A6, A7, A8 | 1, 2, 3, 4, 5, 6, 7, 8, 9 | data inputs |
| GND | 10 | ground (0 V) |
| Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y8 | 19, 18, 17, 16, 15, 14, 13, 12, 11 | data outputs |
| V _{CC} | 20 | supply voltage |

6 Functional description

Table 3. Function table ^[1]

| Input | Output |
|----------------|----------------|
| A _n | Y _n |
| L | L |
| H | Z |

[1] H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.

7 Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|------------------|-------------------------|--|------|------|------|
| V _{CC} | supply voltage | | -0.5 | +7.0 | V |
| I _{IK} | input clamping current | V _I < -0.5 V or V _I > V _{CC} + 0.5 V ^[1] | - | ±20 | mA |
| I _{OK} | output clamping current | V _O < -0.5 V or V _O > V _{CC} + 0.5 V ^[1] | - | ±20 | mA |
| I _O | output current | -0.5 V < V _O < V _{CC} + 0.5 V ^[1] | - | ±25 | mA |
| I _{CC} | supply current | | - | 50 | mA |
| I _{GND} | ground current | | -50 | - | mA |
| T _{stg} | storage temperature | | -65 | +150 | °C |
| P _{tot} | total power dissipation | T _{amb} = -40 °C to +125 °C ^[2] | - | 500 | mW |

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] Above 70 °C the value of P_{tot} derates linearly with 8 mW/K.

8 Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------|---------------------|------------|-----|-----|----------|------|
| V_{CC} | supply voltage | | 2.0 | 5.0 | 6.0 | V |
| V_I | input voltage | | 0 | - | V_{CC} | V |
| V_O | output voltage | | 0 | - | V_{CC} | V |
| T_{amb} | ambient temperature | | -40 | +25 | +125 | °C |

9 Static characteristics

Table 6. Static characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | $T_{amb} = 25\text{ °C}$ | | | $T_{amb} = -40\text{ °C}$ to $+85\text{ °C}$ | | $T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$ | | Unit |
|----------|---------------------------|---|--------------------------|------|-----------|---|-----------|--|-----------|---------------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| V_{OH} | HIGH-level output voltage | $V_I = V_{T+}$ or V_{T-} | | | | | | | | |
| | | $I_O = -20\text{ }\mu\text{A}$; $V_{CC} = 2.0\text{ V}$ | 1.9 | 2.0 | - | 1.9 | - | 1.9 | - | V |
| | | $I_O = -20\text{ }\mu\text{A}$; $V_{CC} = 4.5\text{ V}$ | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | $I_O = -20\text{ }\mu\text{A}$; $V_{CC} = 6.0\text{ V}$ | 5.9 | 6.0 | - | 5.9 | - | 5.9 | - | V |
| | | $I_O = -4.0\text{ mA}$; $V_{CC} = 4.5\text{ V}$ | 3.98 | 4.32 | - | 3.84 | - | 3.7 | - | V |
| | | $I_O = -5.2\text{ mA}$; $V_{CC} = 6.0\text{ V}$ | 5.48 | 5.81 | - | 5.34 | - | 5.2 | - | V |
| V_{OL} | LOW-level output voltage | $V_I = V_{T+}$ or V_{T-} | | | | | | | | |
| | | $I_O = 20\text{ }\mu\text{A}$; $V_{CC} = 2.0\text{ V}$ | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O = 20\text{ }\mu\text{A}$; $V_{CC} = 4.5\text{ V}$ | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O = 20\text{ }\mu\text{A}$; $V_{CC} = 6.0\text{ V}$ | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O = 4.0\text{ mA}$; $V_{CC} = 4.5\text{ V}$ | - | 0.15 | 0.26 | - | 0.33 | - | 0.4 | V |
| | | $I_O = 5.2\text{ mA}$; $V_{CC} = 6.0\text{ V}$ | - | 0.16 | 0.26 | - | 0.33 | - | 0.4 | V |
| I_I | input leakage current | $V_I = V_{CC}$ or GND; $V_{CC} = 6.0\text{ V}$ | - | - | ± 0.1 | - | ± 1.0 | - | ± 1.0 | μA |
| I_{CC} | supply current | $V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$; $V_{CC} = 6.0\text{ V}$ | - | - | 8.0 | - | 80 | - | 160 | μA |
| C_I | input capacitance | | - | 3.5 | - | - | - | - | - | pF |

10 Dynamic characteristics

Table 7. Dynamic characteristics

GND = 0 V; C_L = 50 pF; for test circuit see [Figure 5](#).

| Symbol | Parameter | Conditions | T _{amb} = 25 °C | | | T _{amb} = -40 °C to +85 °C | | T _{amb} = -40 °C to +125 °C | | Unit |
|------------------|------------------------------------|--|--------------------------|-----|-----|-------------------------------------|-----|--------------------------------------|-----|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| t _{pd} | propagation delay | An to Yn; see Figure 4 ^[1] | | | | | | | | |
| | | V _{CC} = 2.0 V | - | 36 | 115 | - | 140 | - | 165 | ns |
| | | V _{CC} = 4.5 V | - | 13 | 22 | - | 28 | - | 33 | ns |
| | | V _{CC} = 5.0 V; C _L = 15 pF | - | 12 | - | - | - | - | - | ns |
| | | V _{CC} = 6.0 V | - | 10 | 19 | - | 24 | - | 28 | ns |
| t _{THL} | HIGH to LOW output transition time | Yn; see Figure 4 | | | | | | | | |
| | | V _{CC} = 2.0 V | - | 19 | 75 | - | 95 | - | 110 | ns |
| | | V _{CC} = 4.5 V | - | 7 | 15 | - | 19 | - | 22 | ns |
| | | V _{CC} = 6.0 V | - | 6 | 13 | - | 16 | - | 19 | ns |
| C _{PD} | power dissipation capacitance | per buffer; V _I = GND to V _{CC} ^[2] | - | 5 | - | - | - | - | - | pF |

[1] t_{pd} is the same as t_{PLZ} and t_{PZL}.

[2] C_{PD} is used to determine the dynamic power dissipation (P_D in μW):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o)$$

where:

- f_i = input frequency in MHz;
- f_o = output frequency in MHz;
- C_L = output load capacitance in pF;
- V_{CC} = supply voltage in V;
- N = number of inputs switching;
- ∑ (C_L × V_{CC}² × f_o) = sum of outputs.

10.1 Waveforms and test circuit

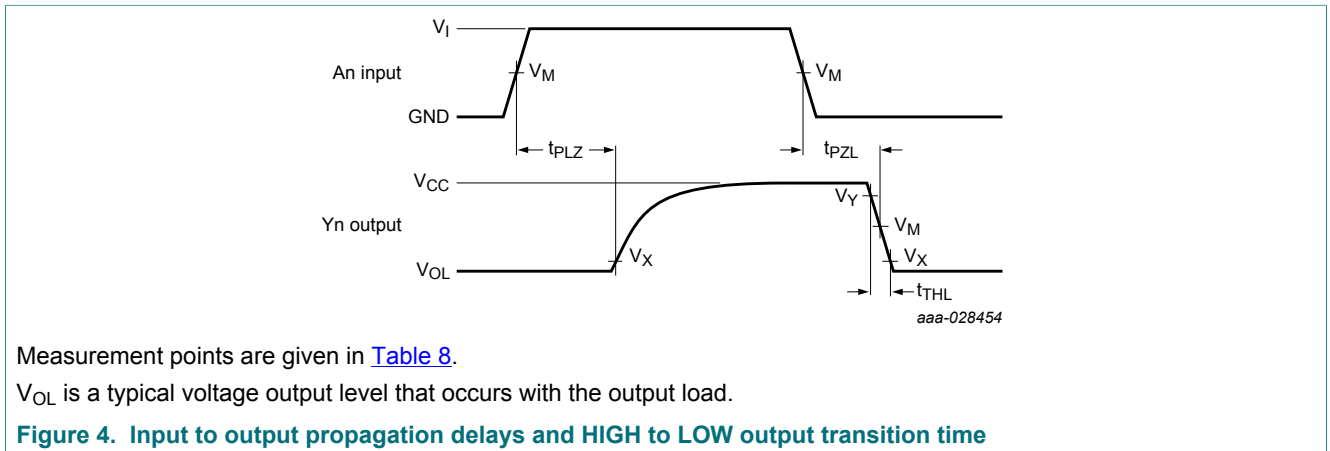


Table 8. Measurement points

| Input | Output | | |
|-------------|-------------|-------------|-------------|
| V_M | V_M | V_X | V_Y |
| $0.5V_{CC}$ | $0.5V_{CC}$ | $0.1V_{CC}$ | $0.9V_{CC}$ |

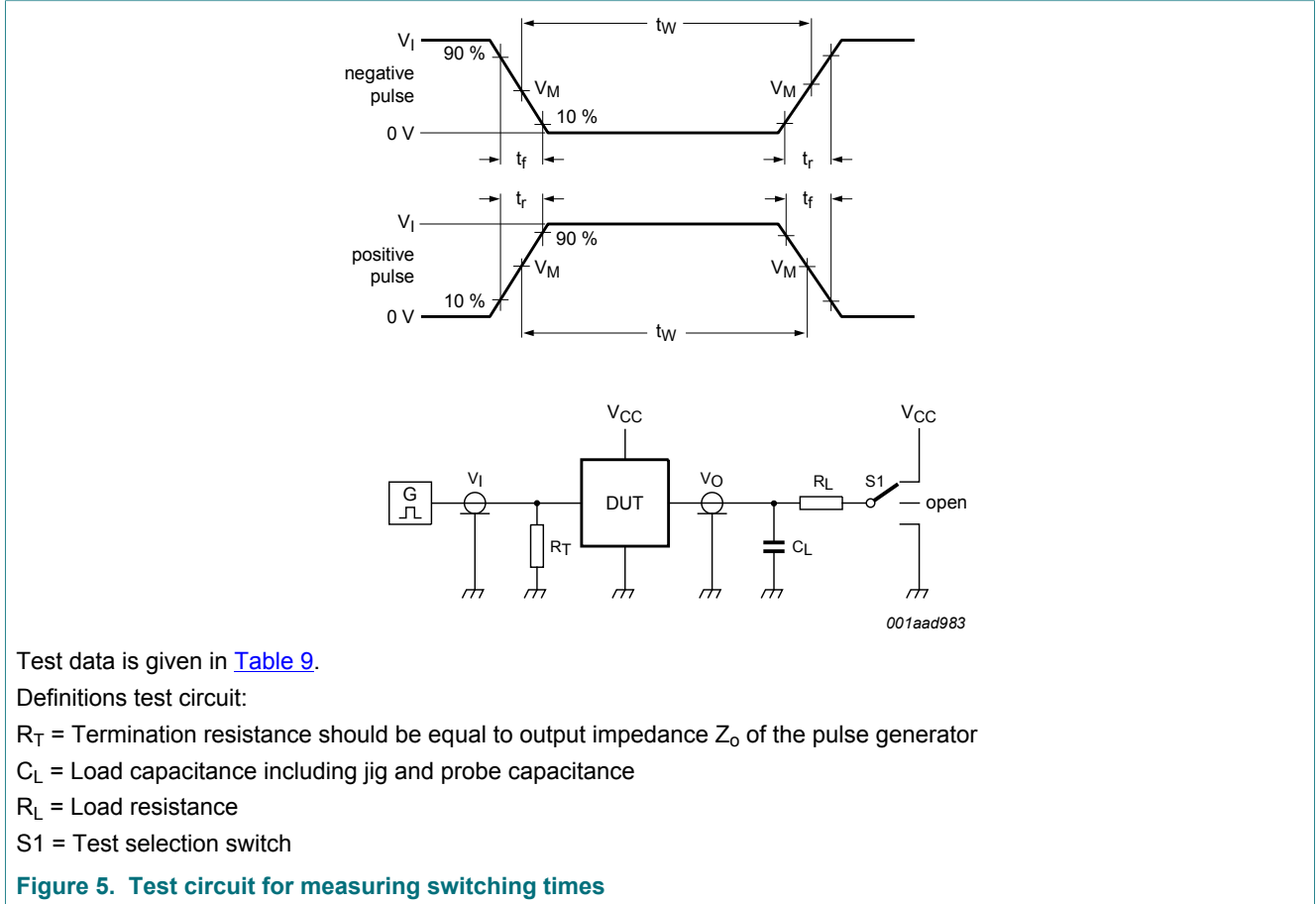


Table 9. Test data

| Input | | Load | | S1 position |
|----------|------------|--------------|-------|--------------------|
| V_I | t_r, t_f | C_L | R_L | t_{pZL}, t_{pLZ} |
| V_{CC} | 6 ns | 15 pF, 50 pF | 1 kΩ | V_{CC} |

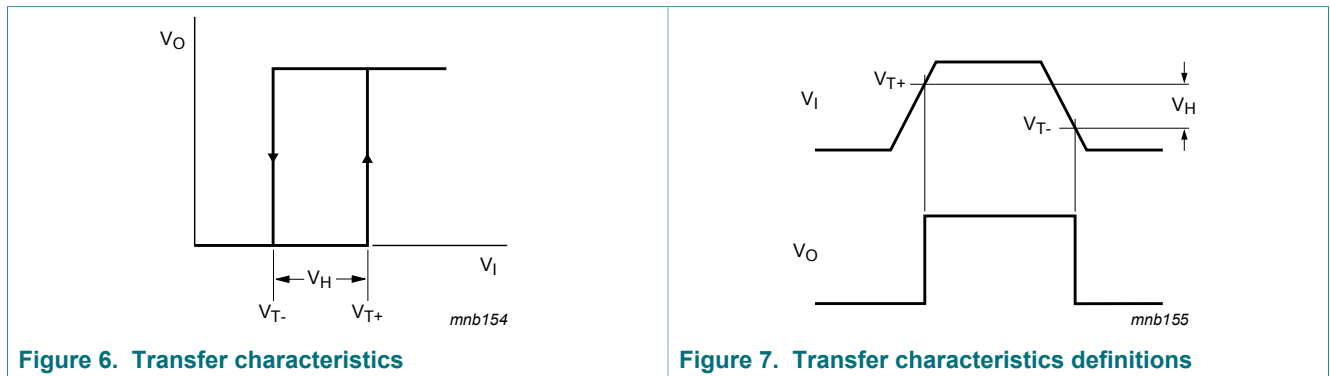
10.2 Transfer characteristics

Table 10. Transfer characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V); see [Figure 6](#) and [Figure 7](#).

| Symbol | Parameter | Conditions | T _{amb} = 25 °C | | | T _{amb} = -40 °C to +85 °C | | T _{amb} = -40 °C to +125 °C | | Unit |
|-----------------|----------------------------------|-------------------------|--------------------------|------|------|-------------------------------------|------|--------------------------------------|------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| V _{T+} | positive-going threshold voltage | V _{CC} = 2.0 V | 0.70 | 1.13 | 1.50 | 0.70 | 1.50 | 0.70 | 1.50 | V |
| | | V _{CC} = 4.5 V | 1.75 | 2.37 | 3.15 | 1.75 | 3.15 | 1.75 | 3.15 | V |
| | | V _{CC} = 6.0 V | 2.30 | 3.11 | 4.20 | 2.30 | 4.20 | 2.30 | 4.20 | V |
| V _{T-} | negative-going threshold voltage | V _{CC} = 2.0 V | 0.30 | 0.70 | 1.10 | 0.30 | 1.10 | 0.30 | 1.10 | V |
| | | V _{CC} = 4.5 V | 1.35 | 1.80 | 2.40 | 1.35 | 2.40 | 1.35 | 2.40 | V |
| | | V _{CC} = 6.0 V | 1.8 | 2.43 | 3.30 | 1.80 | 3.30 | 1.80 | 3.30 | V |
| V _H | hysteresis voltage | V _{CC} = 2.0 V | 0.2 | 0.43 | 0.80 | 0.18 | 0.80 | 0.15 | 0.80 | V |
| | | V _{CC} = 4.5 V | 0.4 | 0.57 | 1.00 | 0.40 | 1.00 | 0.40 | 1.00 | V |
| | | V _{CC} = 6.0 V | 0.5 | 0.68 | 1.10 | 0.50 | 1.10 | 0.50 | 1.10 | V |

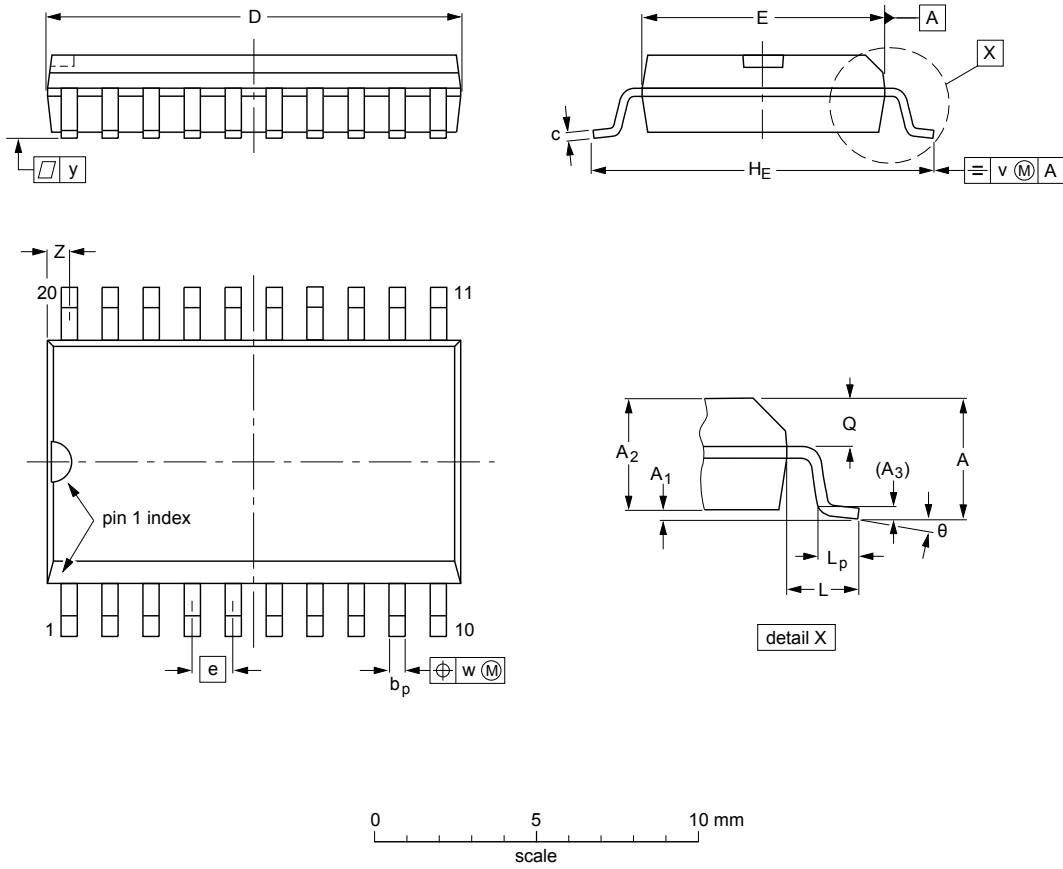
10.3 Transfer characteristics waveforms



11 Package outline

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

| UNIT | A max. | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | E ⁽¹⁾ | e | H _E | L | L _p | Q | v | w | y | Z ⁽¹⁾ | θ |
|--------|--------|----------------|----------------|----------------|----------------|----------------|------------------|------------------|------|----------------|-------|----------------|----------------|------|------|-------|------------------|----------|
| mm | 2.65 | 0.3 0.1 | 2.45 2.25 | 0.25 | 0.49 0.36 | 0.32 0.23 | 13.0 12.6 | 7.6 7.4 | 1.27 | 10.65 10.00 | 1.4 | 1.1 0.4 | 1.1 1.0 | 0.25 | 0.25 | 0.1 | 0.9 0.4 | 8° 0° |
| inches | 0.1 | 0.012 0.004 | 0.096 0.089 | 0.01 | 0.019 0.014 | 0.013 0.009 | 0.51 0.49 | 0.30 0.29 | 0.05 | 0.419 0.394 | 0.055 | 0.043 0.016 | 0.043 0.039 | 0.01 | 0.01 | 0.004 | 0.035 0.016 | |

Note

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|--------|-------|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | |
| SOT163-1 | 075E04 | MS-013 | | | 99-12-27 03-02-19 |

Figure 8. Package outline SOT163-1 (SO20)

12 Abbreviations

Table 11. Abbreviations

| Acronym | Description |
|---------|---|
| CMOS | Complementary Metal-Oxide Semiconductor |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| MM | Machine Model |

13 Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|------------------|---|-----------------------|---------------|------------------|
| 74HC9115 v.3 | 20180410 | Product data sheet | - | 74HC_HCT9115 v.2 |
| Modifications: | <ul style="list-style-type: none"> Type numbers 74HC9115N, 74HCT9115N and 74HCT9115D have been removed from this datasheet. The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. | | | |
| 74HC_HCT9115 v.2 | 19901201 | Product specification | - | 74HC_HCT9115 v.1 |
| 74HC_HCT9115 v.1 | 19880301 | Product specification | - | - |

14 Legal information

14.1 Data sheet status

| Document status ^{[1][2]} | Product status ^[3] | Definition |
|-----------------------------------|-------------------------------|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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